

## Notes on the Life Cycle and Natural History of Butterflies of El Salvador

### II A.—*Epiphile adrasta adrasta* (Nymphalidae-Catonephelinae)

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**Abstract:** The life cycle of *Epiphile adrasta adrasta* Hewitson (Nymphalidae-Catonephelinae) and its natural history were studied in several localities of El Salvador during a period of two years. Special attention was given to the description of the life-cycle stages, time spent in the different stages of the metamorphosis, foodplants during the larval period, and behavior of the early stages and adults. The apparent correlation between the Catonephelinae and Callicorinae is discussed, emphasizing the paradoxical behavior of the species at times suggesting palatability and at times unpalatability to predators.

#### INTRODUCTION

This is the second article of a second series describing what my sons and I have found in relation to the life cycle and natural history of butterflies belonging to the Catonephelinae found in El Salvador, Central America.

The purpose of these articles is to present the life cycle and observations on the early stages of behavior and to record the foodplants of the local species of *Rhopalocera* that according to the available literature have been studied only partially or not at all in the past; we hope thus to alleviate the task of the experts in taxonomy, who in many cases have had only the adult morphological characteristics on which to base their groupings. As a result of the present situation, there is no uniformity of consensus on how to group the families, "as this depends upon each writer's viewpoint" (Klots, personal communication). Thus, what for one modern author is Heliconiidae (Klots, 1960), for another is Heliconiini (Ehrlich and Ehrlich, 1961). It is not surprising therefore to find in relatively recent publications statements such as this: "The Nymphalinae" [which for other authors means Nymphalidae] "have not been the subject of a modern revision (which is sorely needed) and thus the tribal arrangement used below is, in many places, quite arbitrary . . ." (Ehrlich and Ehrlich, 1961).

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In order to determine the species described in this article we submitted specimens of the adults to the American Museum of Natural History, where Drs. Alexander B. Klots and Frederick H. Rindge kindly gave their valuable assistance. Specimens of the early stages have been placed with the museum, where they are available to students of the group.

In an earlier article dealing with the life cycle and natural history of *Prepona omphale ocatavia* Frühstorfer (Muyschondt, 1973a), a description of the country and its climatic zones was given in order to establish a clear idea of the habitat of the species described.

Adults of *Epiphile adrasta adrasta* Hewitson frequent wooded ravines and creeks where second-growth plant communities are found, usually in the proximity of coffee plantations, which can be considered manmade forests, (about the only forests left in the country), at altitudes ranging from about 500 m to 1500 m of elevation.

Late in July 1970, some eggs were found on the underside of the leaves of an unidentified vine. In early September the adults emerged and we were amazed to find two different kinds of butterflies, subsequently determined to be males and females of *Epiphile adrasta adrasta* (we had the same surprise with adults of *Catonephele numilia esite* Felder). Since that time we have reared this species from egg to adult a number of times, from the beginning of the rainy season to mid-dry season (June to March). The eggs and larvae have been kept in individual transparent plastic bags, and photographs as well as measurements have been made of every stage. We kept records of the time spent on each stage of development. The bags were at all times at ambient light and temperature conditions.

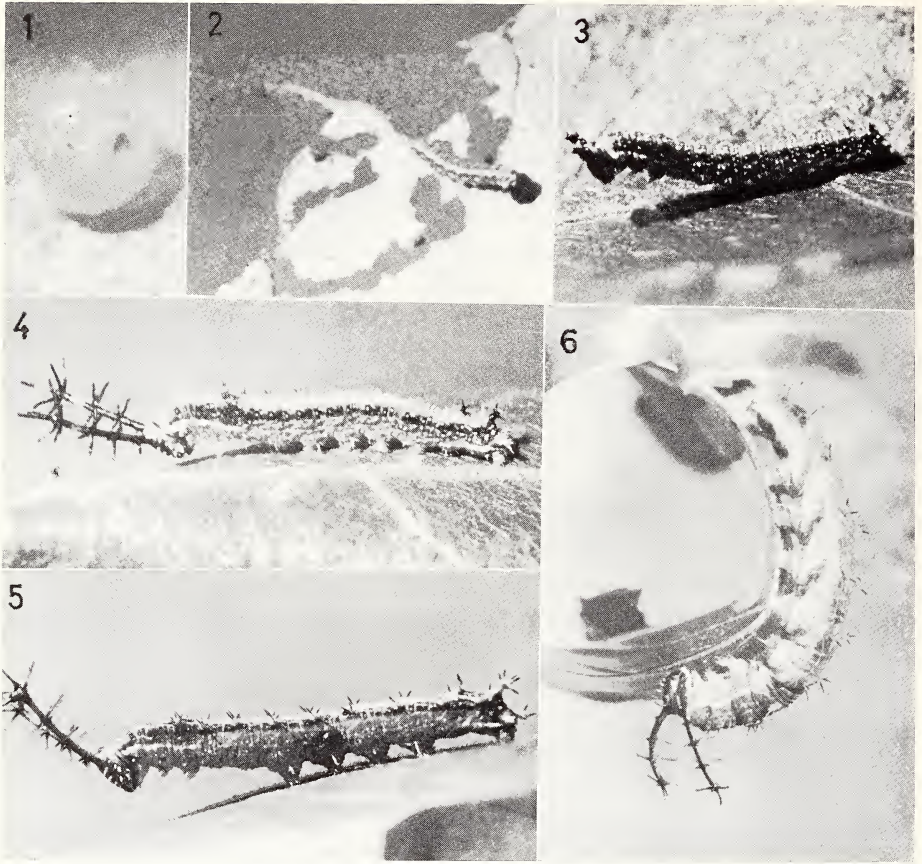
#### LIFE-CYCLE STAGES

*Egg.* Pure white when recently deposited, turning to gray before hatching. Shape a truncated cone, with convex micropyle surrounded by a crown of nine rounded prominences, from which inconspicuous white ribs originate, reaching vertically the base of the egg. About 1 mm long and laterally at widest point. They hatch in 5 days.

*First instar larva.* Head dark brown, naked, roundish, about same thickness as body. Body green dorsally, yellowish subspiracularly, with two dorsal rows of small tubercules. About 1.7 mm when recently hatched and 4.1 mm when ready to molt. Lasts 3-4 days.

*Second instar larva.* Head dark brown with short thick horns ended by a rosette of tiny spines on apex of epicrania. Body greenish brown with a thin yellowish stripe subspiracularly. Many transversal rings of clear tiny tubercules all along the body, and two subdorsal rows of tiny forked spines from second thoracic segment caudad, seventh and eighth abdominal with an additional spine at meson. Measures 7 to 8 mm long before molting in 4 days.

*Third instar larva.* Head brown with long horns on epicranial apex and small thin spines at lateral margins of epicrania. The horns bear three transversal rows of spines each,



FIGS. 1-6. *Epiphile adrasta adrasta* Hewitson.

FIG. 1. Egg. About 1 mm.

FIG. 2. First instar larva, about 3 mm. Prolonged vein at left. Pellet of frass stuck to its body.

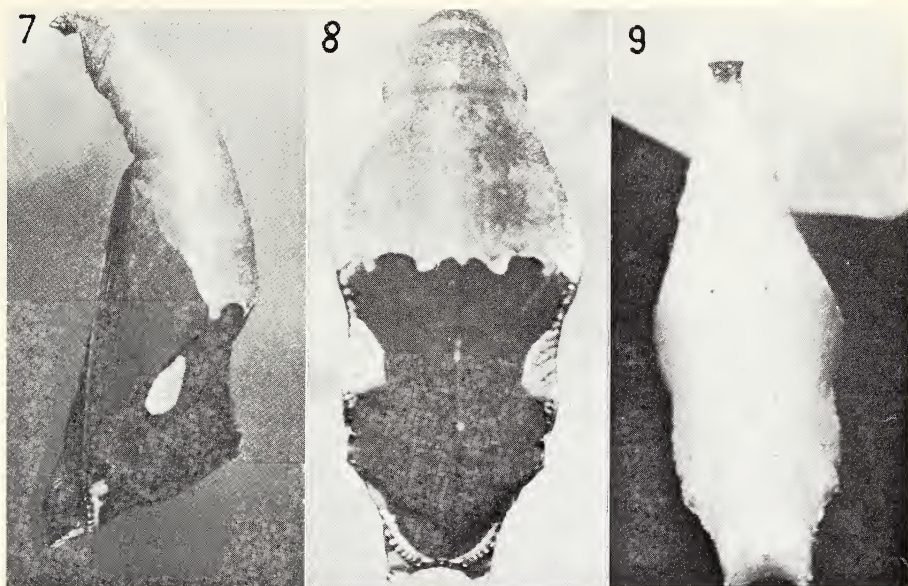
FIG. 3. Second instar larva in typical attitude. About 8 mm.

FIG. 4. Third instar larva in straight attitude. About 1.2 cm.

FIG. 5. Fourth instar larva in raised attitude. About 2 cm.

FIG. 6. Fifth instar larva, about 3 cm.

the first basally, the second at the middle, and the last one distally. Body yellowish brown dorsally with thin black line at meson; then longitudinal dark brown band supraspiracularly, then green down to ventral zone. The whole body with tiny tubercles and a pair of short forked spines on each segment, as in second instar the ones on third thoracic segment and the spines on meson of seventh and eighth abdominal segments being now more prominent. The caudal spines are directed posterad. There is a noticeable light seta at the base of each leg and proleg. On the third thoracic segment there is a black dorsal spot surrounded by a dark brown area and the spines grow at each side of this dark zone. It grows to 1.2 cm in 4 days.



FIGS. 7-9. *Epiphile adrasta adrasta* Hewitson.

FIG. 7. Pupa, lateral view.

FIG. 8. Pupa, dorsal view.

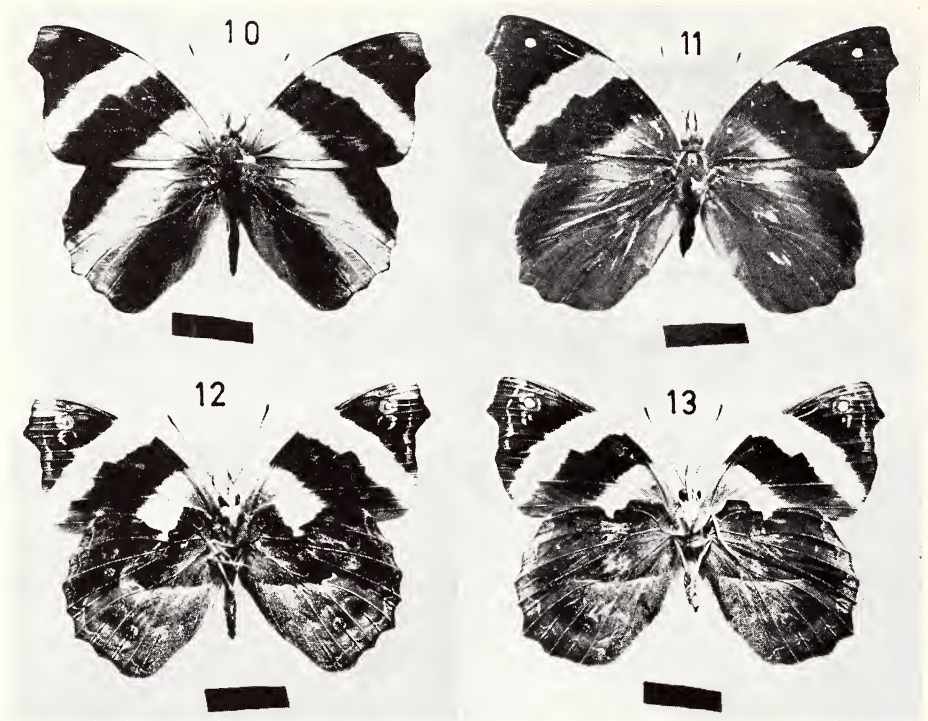
FIG. 9. Pupa, ventral view, about 2 cm long.

*Fourth instar larva.* Head as in third stadium, with bigger lateral spines and epicranial horns that are now more or less incurved caudad and have grown tiny setae on the stem and spines. Body as in third instar but darker dorsally, mostly at thoracic and caudal segments. Spines orange with black forks, except those of the first abdominal segment which have yellow forks, contrasting against dark dorsal color. A slight transverse hump dorsally on third thoracic segment. Median spine on eighth abdominal segment very prominent now. Measures 1.8 or 2 cm before molting in 6-7 days.

*Fifth instar larva.* Head brown with reddish tinge, and light lateral margins of epicrania, with thin whitish spines surrounding the head and a light triangular spot at the frons. Body all green with yellow longitudinal stripe at sides of thoracic segments, thin yellow lines parallel to meson dorsally, and laterally irregular pattern of thin yellow lines. Slanting lateral zones of whitish green. Base of spines and spiracula yellowish-orange. It grows to 2.8 or 3 cm in 9-11 days.

*Prepupa.* Body becomes all green, short and thick, 1.8 cm long, and lasts 1 day.

*Pupa.* Abdomen thickens gradually from green cremaster to wing cases (widest point laterally) then tapers gradually to bifid head. Dorsal emargination at thorax where it joins abdomen, followed by thoracic projection strongly keeled (thickest point dorso-ventrally). Abdomen light green with tiny yellowish spiracula. Wing cases darker green ventrally. Thorax still darker green dorsally. Brown lining bordering wing cases laterally and separation between abdomen and thorax dorsally. Edge of dorsal thoracic keel brown also. A silver patch laterally about mid-wingcase, and a silver lining bordering the head



FIGS. 10-13. *Epiphile adrasta adrasta* Hewitson.

FIG. 10. Male, dorsal view.

FIG. 11. Female, dorsal view.

FIG. 12. Male, ventral view.

FIG. 13. Female, ventral view.

Black bar measures 1 cm long.

dorsally, and dorsal portion of the antennae. Cremaster with flat surface armed with crochets. Measures 1.8 cm to 2.1 cm long, .9 cm laterally at widest point, and .7 cm dorsoventrally at widest point. Duration 8-9 days.

*Adults.* Wing shape the same in both sexes: forewing with projected angle at apex, then a short concavity followed by a long convexity to tornus; inner margin straight. Hind wing rounded with sinuose outer margin.

Drastic difference in dorsal colors between males and females.

*Males:* Forewing dorsally with small dark brown triangle basally, then an orange band covering up to  $\frac{1}{4}$  costal margin down to mid-inner margin, then a dark brown band, parallel to the preceding one, covering up to mid-costal margin to tornus, followed by a second orange band, parallel to the others, covering up to  $\frac{3}{4}$  costal margin to mid-outer margin. The rest of the forewing dark brown except for a small orange spot apically. Hind wing dark brown basally followed by an orange band from mid-costal margin to outer angle. The rest dark brown.

*Females*: Forewing a dark orange basally, slightly lighter at inner margin, then a pale yellow band from  $\frac{3}{4}$  costal margin narrowing as it reaches outer margin just above tornus. The rest dark brown with a small round white spot subapically. Hind wing dark orange except for a dark brown area parallel to outer margin covering from mid-costal margin to close to outer angle.

Ventral wing coloration almost the same in both sexes; forewing a paler version of the male dorsal forewing, showing in addition two small spots subapically: The upper one is gray; the inferior, very dark brown. Hind wing is reddish brown with a row of inconspicuous eyes alongside the outer margin and a small triangular spot about mid-costal margin (bigger in males than in females).

The body is brown above, cream underneath; eyes brown and antennae orange tipped.

Females are usually larger than males, averaging 4.8 cm from tip to tip of the spread front wings in females, 4.6 cm in males. Time spent in the complete metamorphosis varies from 40 to 45 days, the females being slightly slower than the males.

#### NATURAL HISTORY

Eggs and larvae of *Epiphile adrasta adrasta* have been found on several species of Sapindaceae vines belonging to the genera *Paullinia*, *Serjania*, *Urvillea*, and *Cardiospermum*, with a definite predilection for *Paullinia fuscescens*, H.B.K.

*P. fuscescens* is a scandent plant with persistent, shiny, glabrous, rather thick bi-ternate leaves with lance-oblong leaflets from 6 to 15 cm long, sparsely serrate-dentate; its inflorescence consists of axillar racemes of tiny whitish flowers that produce trilobed hard capsules, bearing one seed in each section; the seeds are shiny black, and are half covered by a spongy white arillum. The young stems of the plant are squarish, rounded when mature.

Most vines belonging to the Sapindaceae, in particular the ones belonging to the genera *Paullinia* and *Serjania*, are reputed to possess "narcotic poisonous properties and some of them are employed for stupefying fish" (Standley, 1923). A local common name for this species is "Barbasco cuadrado." The noun barbasco is widely used for plants having fish-stupefying properties.

The eggs of *E. adrasta adrasta* are deposited singly on the undersides of mature leaves.

Upon emerging the tiny larvae eat the upper part of the eggshell and at times part of the walls, move later to the edge of the leaf, and nibble around a vein, baring it. To this vein they attach, by means of silk, pellets of frass that are rescued with their mouthparts at the moment they are expelled from the anus. Soon the vein seems to project beyond the leaf limits. This "vein" is used during the first, second, and sometimes the third stadia as a resting place by the larvae, which keep the head usually pointing outward. They only abandon the vein for feeding purposes, and after that is done they crawl back to it. While in the vein or even on top of a leaf, the young larvae sometimes are seen holding on with the prolegs only, the anterior part of the body being slightly raised. It happens at times that the whole leaf where the vein was

bared is consumed during these stadia; when that happens a new vein is treated the same way and with the same materials in another leaf. First and second-stadia larvae are seen with excreta pellets stuck to their body.

Fourth and fifth instar larvae (sometimes third instar also) wander about the plant, usually on the upper surface of the leaves. They can stay motionless for long periods of time, adopting three peculiar attitudes: one as described for the earlier instars, or straight, holding to the leaf with legs and prolegs, or the S-shaped one. In the last two cases the head is bent forward so that the horns are parallel to the supporting surface. When touched, the larvae strike with their horns with a side or back movement of the body, depending on their stance. If more than one larva happen to meet on the same leaf (which seldom occurs because of the amount of leaf surface available compared with their much smaller number), one might get punctured by the other. When ready to pupate, the larvae clean their digestive tracts by expelling an amount of green liquid mixed with excreta and weaving a silken pad on top of a leaf or on a twig, and affixing thereon their anal prolegs. They stay there straight, parallel to the supporting surface, not hanging in the usual manner of many butterflies.

The pupae, due to the flat surface on their cremaster, stand at an angle in relation to a supporting object, even when they seem to hang from it, which can be checked by turning the object at various angles: The pupae maintain the same relative position. Shortly before the adult emerges, the pupa turns dark gray. Similar to other species in the same group, the pupae of *E. a. adrasta* can emit a creaking sound when molested by wriggling sideways or moving like an accordion.

The adults emerge from the pupa shell very rapidly and find a place from which to hang and expand their wings. This process takes about 15 minutes and they are then ready to fly. In the process they expel an amount of reddish meconium.

Males and females of *E. adrasta adrasta* are swift flyers. The females are seen more often because they fly slowly and at low levels when looking for the foodplant on which to oviposit. The female alights under a mature leaf of the foodplant and deposits one egg on the underside of it. Several eggs are laid on a single vine, but never more than one egg on the same leaf. Oviposition occurs from late in the morning to early in the afternoon.

The adults of this species are not flower visitors, but feed greedily on rotten fruits and animal excrements on the ground and on the sap from tree-trunk wounds. When feeding, the adults lose their habitual alertness and are then easily netted.

We have collected eggs and larvae of *Epiphile adrasta adrasta* mostly from August to February. During the several years we have been rearing this spe-

cies in our insectarium and observing the larvae in the fields, we have not found a case of parasitism or witnessed a case of predation. The only cause of mortality in lab has been a diarrhea causing a softening of the body that is followed by bursting of the skin and death. In the fields we have found small larvae desiccated during the dry season.

#### DISCUSSION

J. Röber, writing in Seitz (1914), credits Müller (no reference is given of the publication) for a good description of fifth instar larva and pupa of *Epiphile orea* Hübner, and reports the foodplants for the genus *Epiphile* in Brazil to be *Paullinia seminuda* Rod. and *Serjania meridionalis* Cambes.

As stated in our article on the life cycle of *Catonephele numilia esite* Felder (Muysshondt, 1973b), the genus *Epiphile* is grouped by Ebert (1969) with the genera *Catonephele*, *Cybdelis*, *Myscelia*, and *Temenis*, under the Catonephelinae subfamily of the Nymphalidae. We include in the same group the genera *Pseudonica* and *Pyrrhogyra*, the latter being perhaps an intermediate between the Catonephelinae and the closely related subfamily Callicorinae, which encompasses the genera *Callicore*, *Diaethria*, *Paulogramma*, and *Catagramma*, because the eggs of that species are more like those of Callicorinae and the larvae more like those of Catonephelinae. It is true that there are striking similarities between the larvae and the pupae of both groups, that their respective behavior is almost the same during their early stages and that the two groups have enough adult characteristics in common to cause some authors to place species belonging to either one (*Myscelia* spp., *Diaethria* spp.) and other species not so closely related (*Eunica* spp., *Mestra* spp., *Hamadryas* spp., and *Biblis* spp.) in a single tribe, the Ergolini (Ehrlich and Ehrlich, 1961). Another point of contact between the two groups is the common use of foodplants belonging to the Sapindaceae. In our experience the only two exceptions to that are: *Catonephele numilia esite* and *C. nyctimus* Westwood, being the only two local species which feed on Euphorbiaceae. Our experience in these groups consists in having reared from egg to adult, in addition to the species described in this article, *C. numilia esite*, *Temenis laothöe liberia* Fabricius, *Pseudonica flavilla canthara* Doubleday, *Pyrrhogyra hip-senor* Godman and Salvin, *Diaethria astala* Guérin and *Catagramma titania* Salvin, plus others belonging to the two groups studied only partially. We hope to be able to present the life cycles of all these species to expose the evident similarities, not only morphological but behavioral as well during their early stages.

*Epiphile adrasta adrasta* larvae, feeding on plants known to contain narcotic/poisonous properties, would be expected to be unpalatable to predators and therefore to have the gaudy coloration associated with that condition,



and move about in the open. In fact the first and second instar larvae of this species seem to rely on crypsis for their defense rather than on the presumable protection derived from the foodplant. The larvae during these two stadia keep themselves motionless on the bared vein of the leaf, imitating portions of leaf tissue still adhering to it. But then, from third stadium on, the larvae expose themselves on the upper surface of the leaves and even if their colors could not be considered gaudy, they are readily spotted on the plant. Contrary to *C. numilia esite* larvae, which are practically covered by a shield of long forked spines, the larvae of *E. a. adrasta* have only two dorsal rows of very short forked spines, whose mechanical value for protection against predators would be minimal. Probably chemical protection provided by plant juices has made unnecessary the mechanical protection that would be supplied by a profusion of spines that might, indeed, become a handicap to larvae moving among masses of small leaves in their foodplants. The pupae, which are at times on tops of leaves and at times on the stems of the plant, disrupt their potentially protective green coloration by the shiny silver lining and conspicuous silver spot on the head and thoracic parts. From these facts we deduce that the noxious components extracted by the larvae from their foodplants must reach a certain degree of concentration in the body of the larvae (two first instars) to become efficient as predator deterrents.

The adults also could be expected to be chemically protected by the foodplant derivatives, but even if they are so protected, they do not rely solely on that for their survival; they also exploit their fast and erratic flight, combining it with the flash-and-hide effect obtained from the contrast between their brilliant dorsal colors and the dull brown color of the hindwings, which almost completely cover the forewings when at rest.

As in *C. numilia esite*, the drastic sexual dimorphism existing in *E. a. adrasta* is extremely puzzling, as no individual of either sex imitates any other of the local butterflies traditionally considered to be protected, thus eliminating the would-be logical explanation of a Müllerian mimicry case. If any benefit is derived by this species from this sexual dimorphism it has not yet been determined.

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